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Impact of meat abstention on mental health. Review of literature

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ABSTRACT

Vegetarianism and veganism are concepts that are growing in popularity nowadays. Simultaneously, the prevalence of mental health disorders, especially depression and anxiety disorders, is rapidly increasing. While meat abstention has numerous health benefits, i.e. lowers the risk of civilization diseases and mortality from cancer, its impact on mental health is controversial. This review aims to summarize the current knowledge on the association between plant-based diets and mental health disorders, focusing on depression and anxiety. We searched through the PubMed database and analyzed the results. Meta-analyses show that following a plant-based diet either has no effect on mental health or is associated with higher depression rates; results on anxiety levels among meat abstainers are heterogeneous. The studies published so far are primarily observational and have a lot of limitations. Additionally, we outlined possible explanations of worse mental health among vegetarians, including the impact of vegetarianism on gut microbiota, nutritional deficiencies, but also personality predispositions to depression and anxiety among people deciding to limit meat consumption.

Keywords: Mental health, depression, anxiety, diet, vegetarian, vegan

1. INTRODUCTION

Meat reduction or abstention is a concept of growing popularity nowadays. The proportion of vegetarians in the general population worldwide is rapidly increasing. Nearly 20% of the world's population has become vegetarian (Leahy et al., 2010). In 2019 in Poland, 8.4% of people declared to exclude meat from their diets (Panel, 2019). Half of those people are 34 years old or younger, which suggests that the number of vegetarians will probably be increasing in the next few years (Panel, 2019). There are numerous types of vegetarian diets. The most popular are: Lacto-ovo vegetarian, pescatarian, vegan. Lacto-ovo vegetarians eat eggs and dairy but refrain from eating meat and fish. Pescatarians only eat fish,

no other sources of meat. A vegan type of diet is the most restrictive. Vegans exclude anything that has animal-based origin, i.e., honey, dairy, eggs, and meat.

Individuals' motivations for limiting meat consumption differ. They most commonly include health reasons, a worldview and compassion for animals, climate change consciousness, and global warming prevention. In addition, the reasons might be cultural, religious, or familial. A vegetarian diet has been proven to decrease the risk of civilization diseases, including cardiovascular diseases, diabetes mellitus, and obesity (Le and Sabaté, 2014; Olfert and Wattick, 2018; Huang et al., 2016). Moreover, there is evidence that plant-based diets reduce the risk of incidence and mortality from cancer (Dinu et al., 2017). Lower total mortality among vegans and vegetarians is observed in several research studies (Le and Sabaté, 2014). Despite all the described health benefits, the impact of plant-based diets on mental health remains controversial, and this work will broadly discuss it.

Besides the increase in the number of meat abstainers, the prevalence of mental health disorders has also been increasing in recent years (World Health Organization, 2017). In accordance with the International Classification of Diseases 11th Revision (ICD-11), the definition of depressive disorders is: "depressive mood (e.g., sad, irritable, empty) or loss of pleasure accompanied by other cognitive, behavioral, or neurovegetative symptoms that significantly affect the individual's ability to function" (World Health Organization, 2019). As depression is diagnosed more frequently, estimates indicate that it will be the most common disease in the world by 2030 (WHO, 2012). ICD-11 definition for anxiety disorders is: "excessive fear and anxiety and related behavioral disturbances, with symptoms severe enough to result in significant distress or impairment in functioning" (World Health Organization, 2019). Current estimates state that up to 1/3 of the population may suffer from anxiety disorders during their lifetime (Bandelow and Michaelis, 2015).

What is more, anxiety disorders are characterized by high comorbidity with other mental disorders (Bandelow and Michaelis, 2015). The etiology of mental disorders such as depression and anxiety is complex and not entirely discovered and described. The knowledge of the impact of diet on the risk of developing the mentioned disorders is still insufficient. The relationship between plant-based diets and their impact on mental health has been an interest of researchers since 1998 (Rodríguez et al., 1998). There is a large number of research studies examining this association currently. Nonetheless, the outcomes of research papers are conflicting. Some studies reveal a positive correlation between meat abstention and positive mental health outcomes. However, others state precisely the opposite. The aim of this review is to provide a summary of the current knowledge on the association between plant-based diets and mental health disorders, focusing on depression and anxiety.

2. METHODS

The search was carried out using Mesh terms in the PubMed database. The search was conducted up to April 2024. The search query included the terms listed below: ("Diet, Vegetarian"[Mesh] OR "meat consumption" OR vegetarian* OR vegan*) AND ("Anxiety Disorders"[Mesh] OR anxiety OR depression OR "mental health" OR "Mental Health"[Mesh] OR "Depression"[Mesh]). Additionally, inclusion criteria for the section "summary of current knowledge" were:

Publication in the last six years (publication years: 2018-2024),

Type of the study: a meta-analysis,

The full text available in English.

For the narrative part of the review, articles majorly focusing on the relationship between meat abstention and mental health disorders were analyzed and included.

3. RESULTS AND DISCUSSION

Four meta-analyses published in recent years were included in the review to present the state of current research (Table 1). In total, twenty-one articles examining the relationship between meat abstention and mental health were chosen for this comprehensive review.

Summary of current knowledge

The results of three meta-analyses indicate an association between depression and meat abstention (Iguacel et al., 2021; Fazelian et al., 2022; Dobersek et al., 2023a). One meta-analysis shows that vegetarianism is not associated with depression (Askari et al., 2022). In the case of anxiety, results significantly differ between meta-analyses: one shows no effects of a vegetarian diet on anxiety rates (Askari et

al., 2022), and one indicates higher anxiety levels among meat abstainers (Dobersek et al., 2023a). In comparison, one presents generally lower anxiety levels in vegetarians (Iguacel et al., 2021).

Table 1 Included meta-analyses characteristics.

Authors	Year of publication	Number of studies included	Results - depression	Results - anxiety
Askari et al.,	2022	11	No significant differences	No significant differences
Iguacel et al.,	2021	13	Higher risk of depression among vegetarians	Lower anxiety scores among vegetarians overall, but results significantly different between age groups
Fazelian et al.,	2022	13	Higher risk of depression among vegetarians, but significant differences between the groups	Not assessed
Dobersek et al.,	2023	20	Higher risk of depression among vegetarians	Higher risk of anxiety among vegetarians

Altogether, such results suggest that meat abstention is correlated with worse mental health. Moreover, the higher the quality of the study included in the meta-analysis was, the stronger the relation between meat abstention and worse mental health was (Dobersek et al., 2023a). Nonetheless, there are meta-analyses in the field supporting different results. This fact indicates that further research is needed in the area to draw certain conclusions.

Limitations of presented studies

It is essential to state that research conducted in the field has a lot of limitations. In four presented meta-analyses, the heterogeneity of the groups was high. Hence, the results might be uncertain. Also, there are inconsistencies in definitions of meat abstainers between studies. Furthermore, questionnaires used to assess the prevalence of depression and anxiety differ between the studies. Additionally, the vast majority of studies are either cohort or cross-sectional.

Thus, meta-analyses include almost entirely observational studies. Estimating the impact of plant-based diets on mental health is difficult as it needs to be distinguished whether this relation is linked causally. Prospective, experimental studies would be needed to determine whether this relation is causal. Notwithstanding, it would be extremely difficult to conduct a randomized clinical study with diets, especially with a duration long enough to influence mental health.

Different approaches to research in the field

There are different approaches to testing the influence of meat abstention on mental health. Assuming that health is not only the lack of the disease but also a positive psychological outcome Dobersek et al., (2023b) proposed a different point of view for the topic. Researchers conducted a systematic review, which included thirteen works. Positive psychological outcome was measured and defined as life satisfaction, positive mental health, self-esteem, vigor, meaning in life, optimism, positive emotion/affect, and psychological well-being. Researchers found that the majority of studies showed a lack of differences between meat consumers and abstainers, and a small minority of studies concluded that meat consumers had better positive psychological functioning.

Surprisingly, research also shows that greater meat consumption is positively correlated with a higher prevalence of depression and, or anxiety in those groups (Nucci et al., 2020). Nucci et al., (2020) conducted a meta-analysis, including seventeen original papers, aiming to explore the association between meat consumption and the prevalence of depression. Pooled data from this meta-analysis suggest that higher red and processed meat intake might potentially be a risk factor for depression. Additionally, in the studies that used validated tools, the strength of the association was higher, and the heterogeneity of the groups was lower.

In this meta-analysis, the emphasis was on meat consumption; the vegetarians group was not separated. Theoretically, the fact that both high meat intake and meat abstention seem to be factors of depression and, or anxiety (depending on a study) is self-

contradictory. However, this might be explained by the fact that people with moderate meat intake have the lowest incidence of depression, so both extremes may increase the risk of mental health problems (Kouvari et al., 2022).

Possible explanations of worse mental health among meat abstainers

Animal-derived products abstaining might be a reason for nutrient deficiencies. Vitamin B12 sources are meat, fish, eggs, and dairy products. Especially vegans might have a deficiency of vitamin B12 if it's not supplemented additionally. It was found that vitamin B12 might be a cause of depression, mostly in the elderly (Petridou et al., 2016). Moreover, lack of vitamin B12 might also be a reason for general anxiety disorder and sleep disorders such as insomnia (Al-Jassem et al., 2024). Another insufficiency that meat abstainers are prone to is zinc deficiency. Zinc is present in meat, dairy, and eggs; however, plants, e.g., nuts, seeds, and whole grains, might also be a source. Unfortunately, zinc-rich plants have poor bioavailability due to the presence of phytate, which inhibits absorbance in the gut (Schaafsma, 2000). Zinc deficiencies might be a cause of mental health problems such as depression.

Additionally, following a vegetarian diet increases the risk of developing a deficiency of specific amino acids, creatine, and omega-3 fatty acids. All of them are linked to a higher risk of mental health disorders (Rao et al., 2008). As stated above, one meta-analysis revealed that anxiety risk was higher only in the group of younger vegetarians (Iguacel et al., 2021). This fact might be explained by greater vulnerability to nutritional deficiencies among younger people as their brains are still developing (Arain et al., 2013). Another factor that influences mental state is gut microbiota. The gut microbiome affects mental state through the secretion of biologically active compounds, such as histamine, polyamides, tryptophan metabolites, and chain fatty acids (SCFAs) (Lach et al., 2018; Peirce and Alviña, 2019). The impact of vegetarianism on microbiota is conflicting.

It increases the level of SCFAs, retinoic acid, and polyamines, which reduce the levels of anxiety, depression, and cognitive impairments (Borrego-Ruiz and Borrego, 2024). On the other hand, meat abstaining decreases the levels of 5-hydroxytryptophan, TMAO, and GABA; such changes increase the prevalence of affective disorders and depression (Borrego-Ruiz and Borrego, 2024). As mentioned, there is no evidence that the correlation between vegetarianism and worse mental health is linked causally. While vegetarianism might increase depression and anxiety risk by altering gut microbiota and leading to nutrient deficiencies, it might also be the fact that people prone to mental health disorders tend to limit meat consumption. Some studies show that the occurrence of a mental disease increases the probability of changing to a plant-based diet (Michalak et al., 2012).

Regarding the personalities of vegans and vegetarians, on average, they have higher levels of empathy (Holler et al., 2021). It was found that higher levels of empathy predict higher prevalence rates of both depression and anxiety (Coxon et al., 2023). A positive correlation between plant diets and poor mental state, notably depression, might be moderated by eating disorders. It relates to people choosing a vegetarian diet for health reasons. Orthorexia is more commonly diagnosed among vegetarians and relates to a higher incidence of depressive symptoms (Brytek-Matera, 2021; Brytek-Matera, 2020; Greetfeld et al., 2021). It was found that the worse mental state among vegans/vegetarians compared to omnivores was moderated by orthorexic tendencies (Hessler-Kaufmann, 2021).

4. CONCLUSION

To conclude, we have summarized the current state of knowledge on the relation between meat abstaining and mental health assessed as depression or anxiety levels. They show that consumption of a vegetarian diet either has no significant effect on mental health or is positively correlated with worse mental health among individuals. There is no evidence that such a relation is causal. Studies conducted in the field have lots of limitations. Thus, further research is needed to confirm these findings. Additionally, we have outlined possible causes of worse mental health among vegetarians, including its risk of nutrient deficiencies, impact on gut microbiota, and orthorexic tendencies in the population.

Author's Contribution

Hanna Behrendt: Conceptualization, methodology, data curation, analysis and interpretation of the data, writing- rough preparation, check

Marcin Głód: Data curation, analysis and interpretation of the data, writing- rough preparation, check

Kinga Filipek: Conceptualization, writing- review and editing, check

Agata Pisklak: Methodology, writing- review and editing, check

Marta Węgrzynek: Methodology, writing- rough preparation, check
 All authors have read and agreed with the published version of the manuscript

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Not applicable.

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Conflict of interest

The authors declare that there is no conflict of interests.

Data and materials availability

All data sets collected during this study are available upon reasonable request from the corresponding author.

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